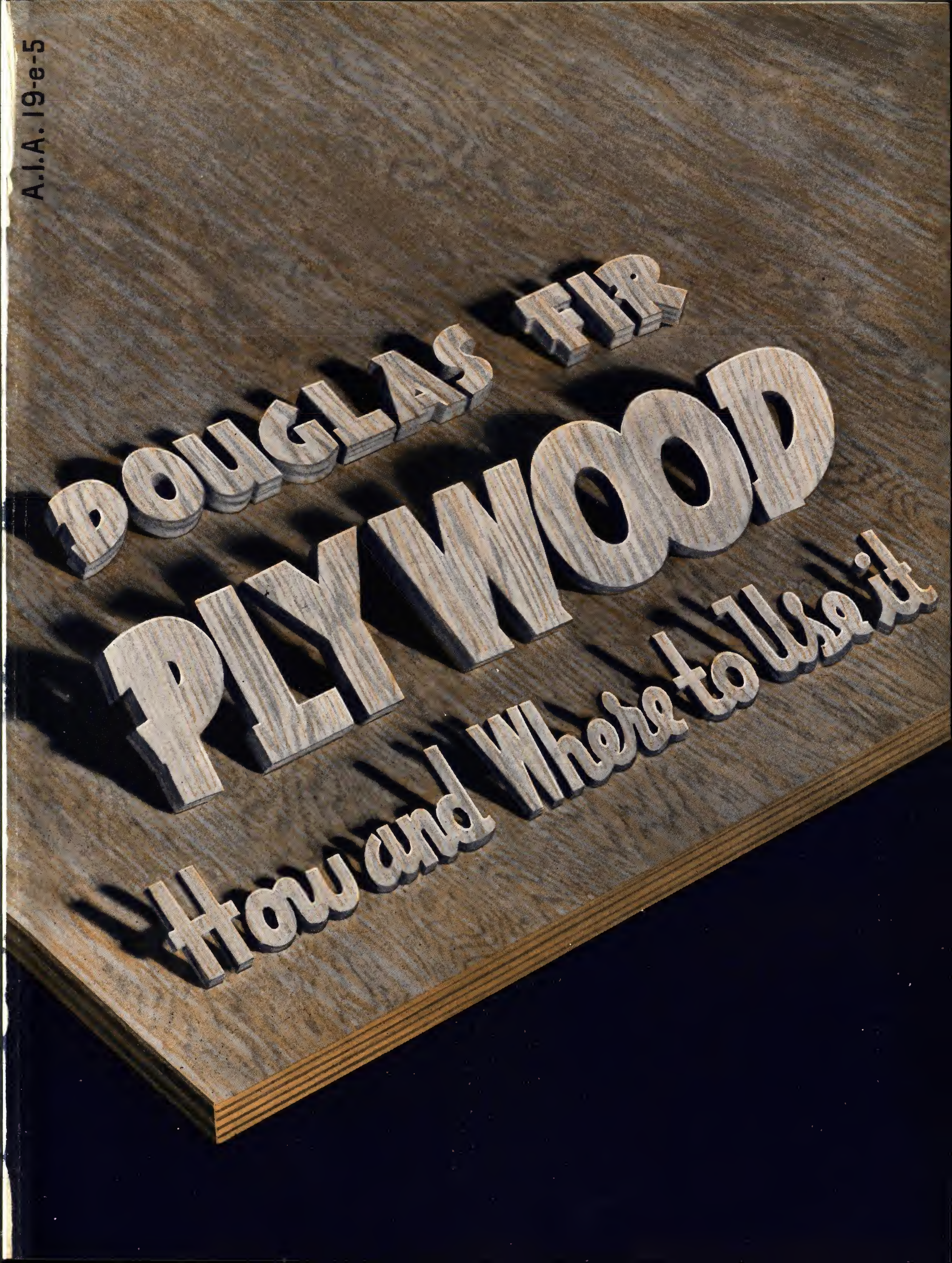
A.I.A. 19-e-5



DOUGLAS FIR PLYWOOD ASSOCIATION

Tacoma Building, Tacoma, Washington

The Association

A non-profit organization of United States manufacturers of Douglas fir plywood, founded to sponsor a continuing program of technical research, to promote the use of this material in construction and industry, and to help users employ it to the best advantage.

Inquiries as to the characteristics or uses of Douglas fir plywood will receive prompt attention. Address DOUGLAS FIR PLYWOOD ASSOCIATION, Tacoma Bldg., Tacoma, Wash., or any of the following industry mills:

ABERDEEN PLYWOOD COMPANY
Aberdeen, Washington

AIRCRAFT PLYWOOD CORPORATION
Seattle, Washington

BUFFELEN LUMBER & MFG. CO.
Tacoma, Washington

CAPITOL PLYWOOD CO.
Olympia, Washington

ELLIOTT BAY MILL COMPANY
Seattle, Washington

HARBOR PLYWOOD CORPORATION
Hoquiam, Washington

M & M PLYWOOD CORPORATION
Portland, Oregon

NORTHWEST DOOR CO.
Tacoma, Washington

OLYMPIA VENEER COMPANY, INC.
Olympia, Washington

OREGON-WASHINGTON PLYWOOD CO.
Tacoma, Washington

PETERMAN MANUFACTURING CO.
Tacoma, Washington

THE PLYLOCK CORPORATION
Portland, Oregon

ROBINSON MANUFACTURING CO.
Everett, Washington

SMITH WOOD-PRODUCTS, INC.
Portland, Oregon

VANCOUVER PLYWOOD & VENEER CO.
Vancouver, Washington

WASHINGTON VENEER COMPANY
Olympia, Washington

WEST COAST PLYWOOD CO.
Aberdeen, Washington

WHEELER OSGOOD SALES CORPORATION
Tacoma, Washington

★ THE PRODUCT

Douglas fir plywood consists of an odd number of thin sheets, or veneers, of selected old-growth Douglas fir—3, 5, or 7 in standard thicknesses—these being laminated with alternating grain direction. The major processes of manufacture are illustrated on this page.

The water-resistant glue used, after setting under hydraulic pressure, forms a bond of high shear strength, far stronger, in fact, than the wood fibers themselves.

In the manufacture of Douglas fir plywood only the choicest Douglas fir logs are used. These are the so-called "peeler" logs, which are less than 10% of the total production of Douglas fir logs. Douglas fir grows on the Pacific slope, where climatic conditions produce a wood combining soft texture and light weight with extraordinary strength. Because of these characteristics, Douglas fir is widely specified for heavy structural timbers.

★ PHYSICAL CHARACTERISTICS

(Test Data on Pages 8 and 11)

Because the veneers are rotary-cut, not sawn, Douglas fir plywood is available in standard sizes as large as 4x8 feet—and in even larger sizes on special order. Largely because of these sizes, Douglas fir plywood makes possible savings of 40% to 75% over ordinary lumber in handling and labor costs.

Because the grain of each ply composing the material is at right angles to the grain of adjacent plies, the strength of a Douglas fir plywood panel is approximately equal in both directions. By contrast, the tensile strength of ordinary lumber may be twenty times as high parallel to the grain as across it, and the modulus of elasticity from fifteen to twenty times as high. Therefore, a panel of Douglas fir plywood will do the work of solid lumber very much thicker and heavier.

On account of its crossed lamination, Douglas fir plywood has no plane of cleavage. Hence it cannot be split except by extraordinary force. It is practically impossible to split even a small piece with a hatchet or axe. Nails and screws can be driven almost at the very edges.

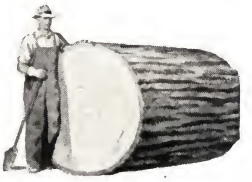
As each veneer, or ply, is scientifically dried before the gluing process, and as any tendency of an individual ply to shrink or expand is prevented by the opposing grain of adjacent plies, Douglas fir plywood is extraordinarily warp-resistant. Once in place, it is *warp-proof*.

Its light weight is demonstrated by the fact that a cubic foot of 3/8-in. 3-ply of 10% moisture content—for example—weighs only 34 lbs.

Douglas fir plywood comes sanded to satin-smoothness, reducing labor costs at the point of construction.

To summarize, Douglas fir plywood combines in one large unit, strength; rigidity; smoothness; warp-proofness; crack-proofness; thermal and sound insulation value; and ease of speedy construction.

How Douglas Fir Plywood is made:



1 Selected Douglas Fir logs are cut to length and barked.

2 Then turned on a giant lathe and peeled off into endless lengths of thin wood sheets.

3 These sheets of wood are cut to size, laid cross-grain, and glued together flat with water-resistant glue under hydraulic pressure. (Arrows show direction of grain.)

4 The result is giant panels having all the good qualities of natural wood plus size and convenience,—but with advantages of strength, stiffness, and freedom-from-splitting.

★ AVAILABLE THROUGHOUT THE U. S.

Most building material dealers in every section of the country stock Douglas fir plywood in an assortment of sizes and grades. However, if you are unable to obtain it in your community, write to the Association, or to any of the mills listed on page 2.

★ PRICE

Douglas fir plywood is inexpensive. In most thicknesses it costs less per surface foot installed than competing materials. For example, ¼-in. Douglas fir plywood Wallboard retails for 4¢ to 7¢ a sq. ft., depending on quantity and the dealer's freight cost.

★ REPRESENTATIVE USES

Space permits mention of only a few of the hundreds of uses for which Douglas fir plywood's unique characteristics have won it acceptance.

Automobile Body Parts
Auto Trailers
Benches
Boxes, Crates and Chests
Breakfast Nooks
Bulletin Boards
Cabinet Work
Cafe Booths
Clothes Chutes
Closets
Cold Rooms
Concrete Forms
Convention Booths
Crack-proof Walls and Ceilings
Dark Rooms
Dust-proof Coal Bins
Dust-proof Drawers and Drawer Bottoms
Flooring
Freight Car Lining
Garages and Lining
Ironing Boards
Linoleum Base
Lockers
Modern Furniture
Office and Other Partitions
Porch Sun Rooms
Portable Houses
Radio Cabinets
Removable Dance and Gym Floors
Screens
Sheathing
Shelving
Store Fixtures
Subflooring
Table-tennis Tables
Wainscoting
Window Displays
Window Seats

★ CRACK-PROOF WALLS AND CEILINGS

Used for walls and ceilings, Douglas fir plywood gives crack-proof strength and a smoothly sanded natural-wood surface that takes any finish—natural-grain, paint, plastics or paper. Being both low in surface-foot cost and repair-free, this versatile material is economical and has all the advantages for dry-built construction.

As an insulating material Douglas fir plywood has all the advantages of natural wood. The big panels reduce to a minimum the lineal footage of joints—and these joints *stay tight*—permanently proof against air infiltration, thus providing also the valuable insulation of dead air space.

Douglas fir plywood in the Wallboard grade, ¼-in. thick, is the most widely used item for walls and ceilings. For especially substantial construction, ½-in. or even thicker is sometimes used.

As Douglas fir plywood is strong and rigid, it cannot bulge, sag or crumble.

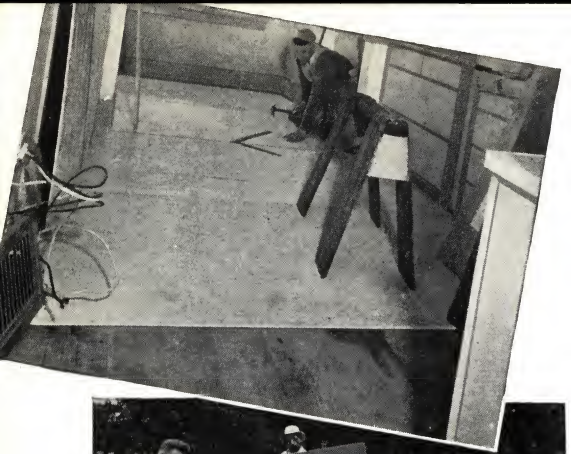
★ WAINSCOTING

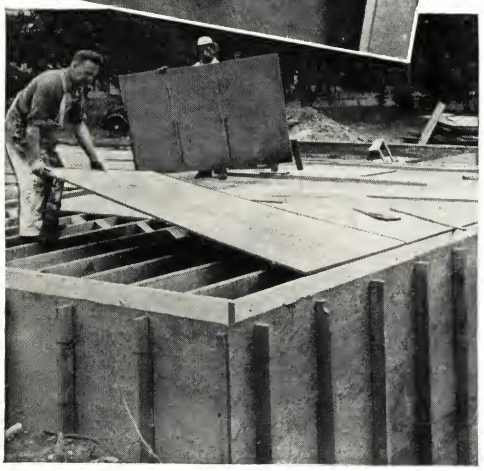
Both because Douglas fir plywood combines low surface-foot cost with labor-saving sizes, and because it lends itself to so many attractive finishes, this material is increasingly preferred for wainscoting.

Above: **(1) Painted Douglas fir plywood walls, ceilings, doors and casework in this living room. (2) Stained Douglas fir plywood walls and woodwork in this library.**

Upper: **Natural Douglas fir plywood walls and casework in this dining room.**

Lower: **Papered Douglas fir plywood walls and painted casework in this kitchen.**





Above: (1) ¼-in. Douglas fir plywood wallboard over old floors to provide smooth base for linoleum.

(2) The ⅝-in. Douglas fir plywood panels, having served for concrete forms, are being laid as subflooring.

Upper: One-man panels of $\frac{5}{16}$-in. Douglas fir plywood sheathing grade provide warm and rigid construction.

Lower: Douglas fir plywood sheathing grade for shingle base.

★ PARTITIONS

Douglas fir plywood's great strength and giant panel sizes make it an ideal material for partitions whether permanent or removable. It is labor-saving and damage-proof. Douglas fir plywood partitions are homogeneous structures extraordinarily resistant to all stresses. An economical partition of plywood—if not less than ½ in. thick—may be constructed with simply a cap and shoe.

★ SUBFLOORING AND FLOORING

For subflooring, or flooring to be covered by carpet or linoleum, and as a finish floor in attics and other areas not subjected to severe service, Douglas fir plywood offers a combination of economies and other advantages not otherwise obtainable.

The huge panels save at least 60% in flooring and subflooring labor by minimizing the work of sawing, fitting, joining, and nailing. The great reduction in lineal footage of joints, and the fact that plywood joints will not open, practically eliminate air leakage. In addition, Douglas fir plywood has all the insulating properties of ordinary lumber.

Used as subflooring, Douglas fir plywood contributes much greater structural strength than ordinary materials. The ⅝-in. thickness is most often used for subflooring. (See chart on page 11.)

Douglas fir plywood floors and subfloors tend to *prevent squeaking* because this material grips nails more tenaciously than ordinary lumber, and because the thicker panels do not yield under the weight of a person walking.

Not being lapped at the edge, every square inch of Douglas fir plywood covers surface. This means a 20% saving over ordinary subflooring in material footage alone and, moreover, the advantage of labor economies.

Douglas fir plywood is an ideal base for linoleum and other resilient floorings. Experienced floormen prefer plywood to any other base on account of its smooth, level, hard surfaces, its minimum of joints; and freedom from cupping. A longer life and a better appearance may be expected from floorings laid on Douglas fir plywood.

Douglas fir plywood is also used for removable dance and gymnasium floors and social and sporting events or similar gatherings. The large lightweight sections can be laid down or taken up quickly.

★ SHEATHING

Structural superiority, insulating and wind-proofing properties, plus demonstrated economy have established Douglas fir plywood as a preferred material for sheathing.

Tests at the U. S. Forest Products Laboratory at Madison showed ¼-in. fir plywood to be 40% more rigid than conventional materials.

Tests at Stanford University, under Professor L. S. Jacobsen, demonstrated that Douglas fir plywood will withstand terrific strain.

Quoting from his report, "For purposes of sheathing closed panels (sections) to resist seismic loads with a minimum distortion of nailed joints, the ¼-in. plywood is decidedly superior to any of the other forms of sheathing.

"In the static tests following the dynamic, panels (sections) sheathed with ¼-in. plywood are decidedly superior to panels sheathed with any of the other forms of sheathing in regard to minimum elastic distortion, maximum load, maximum stiffness recovery, and maximum resilience for a given distortion of 1.5 inches.

"The light weight of the ¼-in. plywood panels constitutes an additional factor of safety if the structure is subjected to dynamic loads of seismic origin."

Tests at the University of Washington, under Professor Bror Grondal, foremost shingle authority, were reported by him, "Douglas fir plywood, as a base for western red cedar shingles, provides the necessary nail-holding qualities, even when $\frac{5}{16}$-in. plywood, the thinnest tested, is used."

Municipal authorities, such as the Building Department of the City of Detroit, Mich., as well as Government Housing experts, have approved $\frac{5}{16}$-in. plywood sheathing.

At the last annual meeting of the Pacific Coast Building Officials Conference (October 1937) $\frac{5}{16}$-in. plywood sheathing—as well as ⅝-in. plywood subflooring and other items—was officially recognized and, in accordance with regulations governing all code changes, given approval for the Uniform Building Code adopted by nearly 200 cities and towns from California to New York and Florida.

This utility material is not only low in first cost, but admits savings of 40% to 60% in labor. The 4 x 8-ft. panels of $\frac{5}{16}$ in. weigh only 30 lbs. and are easily handled and erected by one man. They require fewer and smaller nails than other materials.

The ⅜-in. and ⅝-in. thick plywood sheathing is available where required by service conditions.

★ PRE-FABRICATED CONSTRUCTION

Intensive research and practical experience with a multitude of methods and materials have indicated that pre-fabricated panels or wall units may be the solution to the low-cost housing problem.

Douglas fir plywood is now generally recognized by the leading architects and builders as the most generally suitable material for such panels. It is large in size. It possesses structural strength and rigidity. It is easily bonded permanently to a wood frame, in shop or field, with glue stronger than the wood itself. It is light so that large panels are handled easily by one man. It presents a smooth surface for natural or painted finishes. It is low in cost.

The United States Forest Products Laboratory demonstrated the practicability of this construction three years ago by building a plywood house with pre-fabricated panels using the stressed covering principle. Douglas fir plywood panels were glued to a frame of light lumber studs or ribs for the side-walls, and to joists and rafters for the floor and roof panels. By utilizing this boxed girder principle with sturdy plywood for the top and bottom flanges, substantial reductions in the size of studs, joists, and rafters were effected.

Meanwhile, private housing institutes and governmental agencies have turned to plywood as the material with which to solve the low-cost housing problem.

In all sections of the country, prominent architects and builders have established standard pre-fabricated housing designs with Douglas fir plywood panels and have built numerous structures with marked success.

Conventional exteriors may be employed, but with the advent of resin-bonded material, Douglas fir plywood tastefully painted or finished to suit the most discriminating, offers to architects and builders an economical material for exteriors of low-cost houses.

Large shop-built units of Douglas fir plywood supplement conventional construction or compose entire pre-fabricated systems

A cold storage plant being constructed with exterior panels of resin-bonded Douglas fir plywood—a use demanding permanent moisture resistance inherent in this grade

★ USED AS A CABINET MATERIAL

Warp-proof Doors—Douglas fir plywood has found world-wide use for door panels and for the construction of dust-proof flush doors. In both it combines lightweight strength with extraordinary warp-resistance at modest cost.

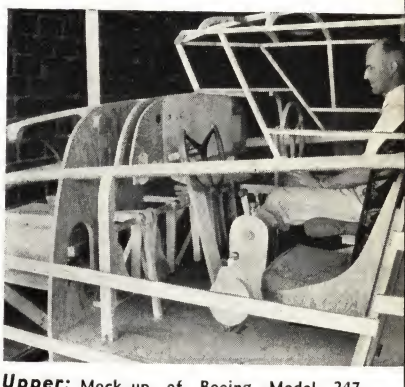
Closets, Cupboards and Cabinets—By eliminating piecing and fitting, Douglas fir plywood's large panel sizes greatly reduce the cost of this kind of construction, besides giving it split-proof, warp-resistant strength. Cabinet drawers, bins and doors made of Douglas fir plywood will never stick, and the joints remain permanently tight and dust-proof. Nails and screws can be placed close to the edges without danger of splitting.

Shelving and Bookcases—Warp-proof, split-proof shelving and bookcases can be built with Douglas fir plywood for even less than if ordinary lumber were used. Moreover, plywood shelving can be thinner—more graceful in appearance—without sacrifice of strength.

Breakfast Nooks and Other Built-ins—Damage-proof built-ins, breakfast nooks, ironing boards, window seats, etc., can now be built at considerably lower cost with Douglas fir plywood. This is because it eliminates piecing and glue-up work, and because of the low surface-foot cost of the material.

Store Fixtures—Douglas fir plywood builds extra-strength, repair-free, and efficient store fixtures at a lower cost than any other suitable cabinet lumber. Moreover, doors, drawers, and bins of Douglas fir plywood keep merchandise dust-proof.

Trailer interior walls and casework are of Douglas fir plywood. Cargo trailers, truck bodies, and box-cars are lined with it also



Upper: Mock-up of Boeing Model 247. This full scale model exemplifies the structural rigidity and workability of Douglas fir plywood

Lower: Douglas fir plywood forms surfaces easy to decorate for temporary store fronts and provide safety and privacy at low cost

★ INDUSTRIAL USES

The demand for smooth, rugged car linings which would have a minimum of joints, and would be proof against dust, cinders, and condensation, has led to many of the great transcontinental lines adopting Douglas fir plywood for both ceilings and wall lining in thousands of new box-cars.

Ruggedness without excessive weight is a prime factor in the adoption of Douglas fir plywood in the entire transportation field. The modern streamline train, auto and truck bodies, buses, airplane mock-ups, the ubiquitous trailer, portable shipping containers, and cargo trailers are but a few examples where industries have capitalized on the strength properties of plywood panels. Outside of the transport field, Douglas fir plywood finds application in toys and games, furniture of all kinds, trunks and suitcases, and scores of other industries.

★ HOT-PRESSED PLYWOOD FOR EXTERIORS

Although plywood made with cold water-resistant glues has proved its serviceableness in concrete formwork and other severe uses, there has been an increasing demand for a Douglas fir plywood that would be permanently "foolproof and waterproof" for exterior uses involving high moisture hazards, such as outside walls of houses, boats and surfboards, sign-boards, and linings for refrigerator cars. Accordingly, several plywood manufacturers are now producing resin-glued plywood in which the veneers are bonded by means of hot-pressed resin glues, universally recognized as the ultimate in waterproof adhesives.

This new departure in Douglas fir plywood, already proved through many years of experience in the United States and Europe, opens up entirely new fields for the giant fir plywood panels. This 100% waterproof, permanent product for exterior service supplements the standard plywood panels so successfully employed for a host of interior uses and for less permanent exterior purposes, and makes Douglas fir plywood available in suitable grades as a material for practically any purpose.

★ FINISHING DOUGLAS FIR PLYWOOD

A great variety of attractive finishes may be obtained with Douglas fir plywood.

Only materials of the best quality should be used, whether mixed on the job by the master painter and decorator, or bought in the prepared form from a reputable manufacturer. In either case, have the work done by a competent, skilled painter and decorator. Where prepared paints are used they should be appliel in strict accordance with the manufacturer's directions.

For General Purpose Decoration

New Douglas fir plywood interiors should be given at least three coats of paint mixed according to the formulas on the following chart and tinted, if desired, with pure colors in oil.

	Priming coat	Second coat		Flat finishing coat		Semi-gloss finishing coat	
		A*	B*	A*	B*	A*	B*
All Purpose Soft Paste White Lead	100 lb.	100 lb.	100 lb.	100 lb.	100 lb.	100 lb.	100 lb.
Raw Linseed Oil	3 gal.						
Turpentine	2¼ gal.	1¼ gal.		1¾ gal.		¾ gal.	
Flatting Oil, Lead Mixing Oil or Lead Reducing Oil			2½ gal.		2½ gal.		2 gal.
Floor Varnish		¾ gal.		1 pt.		1¼ gal.	1 gal.
Liquid Drier	1 pt.	½ pt.		½ pt.		½ pt.	
Gallons of Paint	8½	5¼	5½	5	5½	5¼	6
Coverage per gallon (approx.) square feet	700	800	800	800	800	800	800

*Either formula A or B may be used in each case, depending upon availability of materials and personal preference of the decorator.

Variety Finishes For Interiors

The variety texture known as stippling is one of the simplest, commonest and most satisfactory interior finishes. It is accomplished by striking the wet paint with a wall stippling brush. It eliminates brush marks and imperfections in the surface.

In addition, there are a great number of figures, such as crumpled roll, sponge mottle, modernistic, tiffany and glazes, and finishes accomplished with masking tape and stencils, that any capable decorator can produce.

Furthermore, finishes with a certain amount of relief, providing texture and depth, can be produced with white lead plastic paint for the finishing coat. This paint is mixed as follows:

All Purpose Soft Paste White Lead	100 lb.
Dry Whiting	22 lb.
Pure Turpentine	¾ gal.
Floor Varnish	½ gal.
Drier	¼ pt.
Gallons of Paint	5 gals.
Coverage per Gallon (approximate)	140 sq. ft.

With this paint, such effects as travertine, vein relief, swirl overlay, caenstone, tapestry, basket weave, waving reed, bamboo and others may be produced by competent decorators.

Staining Interior Woodwork—Apply resin sealer and one coat of oil stain of color desired. Knife putty all nail holes with colored putty to match the stained woodwork and sand lightly.

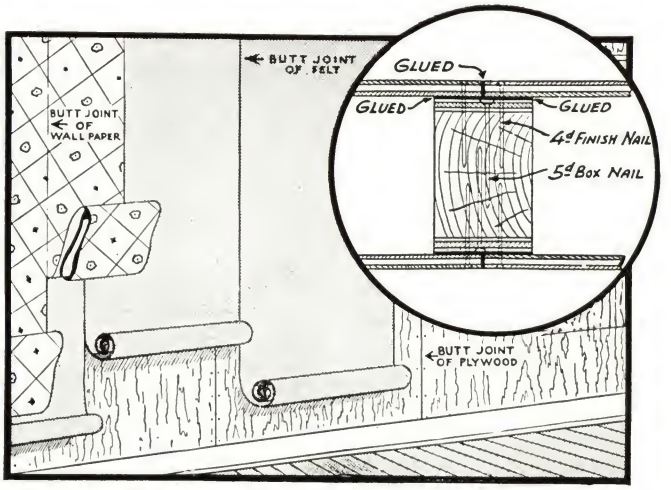
Second Coat (Sealer and Surfacer)—Apply one coat of pure white shellac thinned according to manufacturer's directions, and sand lightly when dry.

Finish—Apply two coats of interior gloss varnish, sanding between coats, allowing ample time for drying before sanding. Rub down gloss finish with pumice stone and oil until the desired appearance is obtained.

Dull Finish—Apply two coats of recommended flat varnish.

Natural Finish—Attractive and economical natural finishes may be obtained by using one or two coats of pure white lacquer, sanding after each coat, and one or two coats of wax. Shellac may be used in place of lacquer.

Skilled painters and decorators can obtain various finishing effects specified by the architect. Strikingly beautiful results may be obtained by wire-brushing or sand-etching to remove part of the softer springwood.



Felt or muslin, butt-jointed, is recommended underlay for wallpaper. Inset details crack-proof panel joint

Wallpaper—Plywood may be papered, when desired, without difficulty. Care should be taken to see that the wall studs are well-seasoned so that there will be no shrinkage to cause hair-cracks between the panels. Cheap building felt or muslin as a base for the paper is generally recommended. The joint detail E on page 7 is especially adapted for use under wallpaper.

For Exterior Uses

Edges are preferably knifed with white lead. Outside surfaces of plywood exposed to weather should be finished carefully with three coats of high-quality paint. In extremely damp localities, the interior should be coated also.

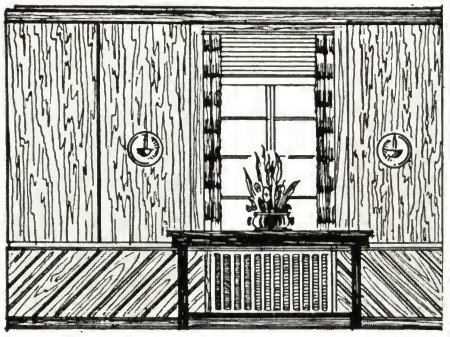
Priming—Without exception, ready-mixed paints used for priming should be reduced with pure raw linseed oil—usually with one gallon of oil to one of paint. Apply subsequent coats as the paint manufacturer recommends.

In mixing aluminum paint, which is especially moisture-resistant, use only high-grade vehicles—such as kettle-bodied oil or long oil spar varnish. Do not use ordinary boiled oil or raw linseed oil. Many paint manufacturers now offer a vehicle specifically prepared for aluminum powder.

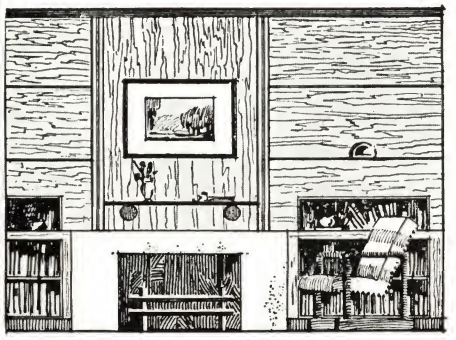
Methods of Application—On large unbroken surfaces, apply priming and subsequent coats like calcimine—sweeping the brush in semi-circular fashion. If the surface is small or broken by paneling, etc., follow the grain.

Use driers very sparingly. Never use shellac on Douglas fir plywood exposed to weather.

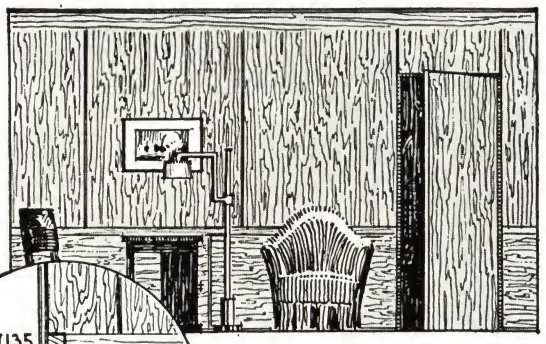
Douglas Fir Plywood is Perfect Material for Expression of Modern Interior Themes - - INEXPENSIVELY



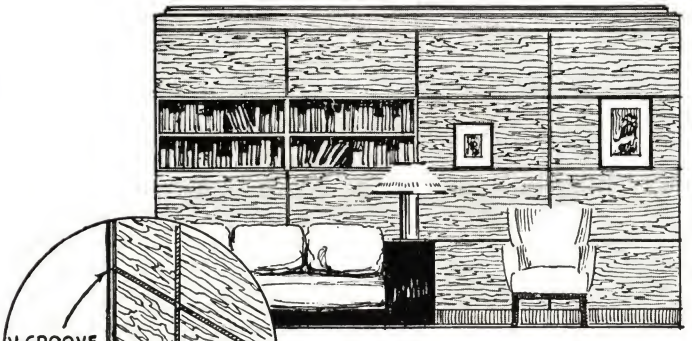
Vertical Plywood sheets with diagonal wainscot



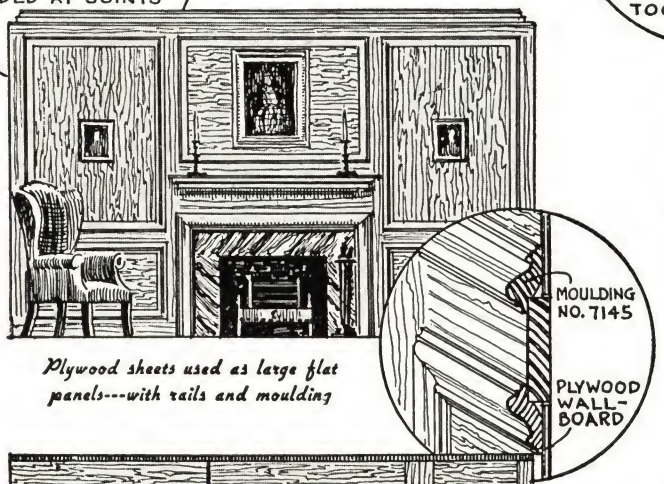
Mixed horizontal and vertical sheets of Plywood



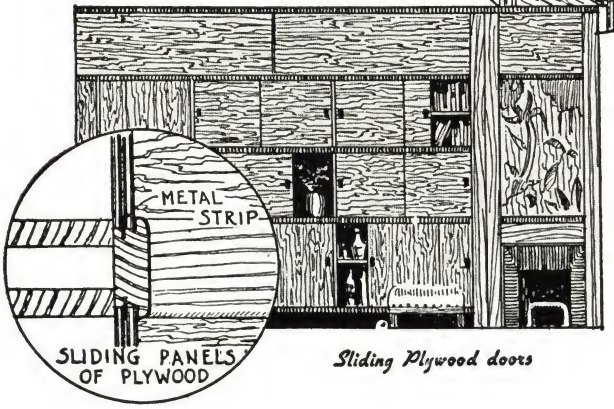
Vertical Plywood panels with horizontal wainscot



Horizontal Plywood in small sheets with "V" grooved design



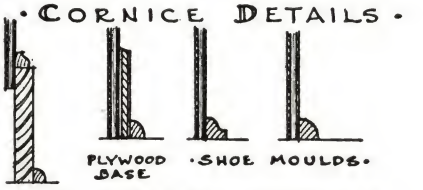
Plywood sheets used as large flat panels---with rails and moulding

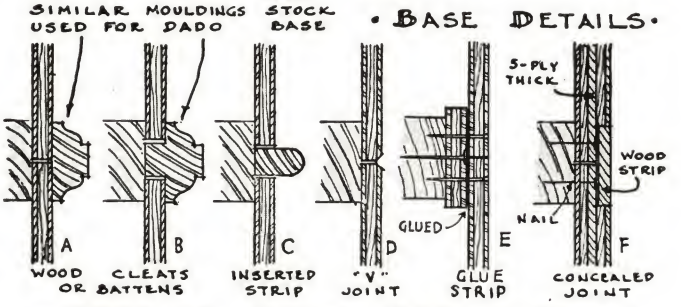


Sliding Plywood doors

STOCK METAL MOULDING

TO EMPHASIZE SMALL MOULDINGS AND GROOVES— FINISH IN A TONE OR COLOR CONTRASTING WITH THAT OF THE WALL





• VARIOUS JOINT TREATMENTS •

INTERIOR WALL DESIGNS USING PLYWOOD

★ TEST DATA ON DOUGLAS FIR PLYWOOD

In order to present a general comparative picture as to the strength properties of Douglas fir plywood, and other materials sometimes used in its place, the results of a series of tests conducted at the Northwest Testing Laboratory, the Northwest representative of the nationally-known Pittsburgh Testing Laboratory, are summarized at the right:

In the tension tests, all specimens were 3″x18″; in the compression tests, 6″x6″ pieces were used. Tests on each material were conducted under exactly the same conditions.

Thickness of material	Tension		Compression	
	Ultimate load	Ultimate stress	Ultimate load	Ultimate stress
LOAD ACTING WITH THE GRAIN OF FACE PLIES				
1/4″, 3-ply	5250	6484	4198	2855
3/8″, 3-ply	5644	4750	6630	2860
1/2″, 5-ply	8024	5135	10492	3497
5/8″, 5-ply	8132	4350	10644	2893
3/4″, 5-ply	8912	4074	18538	4186
LOAD ACTING ACROSS GRAIN OF FACE PLIES				
1/4″	2552	3291	908	609
3/8″	4684	4141	5206	2180
1/2″	7664	5108	6462	2162
5/8″	8326	4491	9096	2472
3/4″	8796	3932	15262	3436
TESTS ON OTHER MATERIALS				
A-3/16″	1248	2189	390	346
B-3/16″	1276	2180	846	751
C-1/4″	264	352	826	550
D-7/16″	152	126	448	170
E-1/2″	370	248	690	230

Key: Material A, old-style fibre wallboard; B, hard, compressed board; C, plaster-board; D and E, insulating boards.

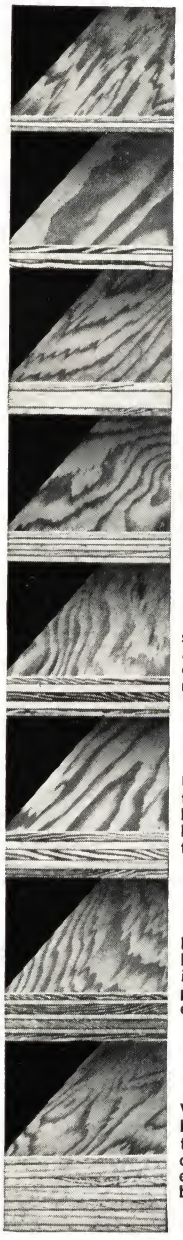
Nail-Pulling Tests—Nail pulling tests were also made on Douglas fir plywood, and the other materials tested in tension and compression, to ascertain their resistance against nail-heads pulling through, when the materials were nailed to a wood base. Eighty-five per cent of the cement coated box nails (a more severe test) used with the plywood were pulled out of the base when the plywood was pulled loose, whereas every other material was pulled loose without removing a single nail; the nail-heads simply punctured the other materials. With plywood the load required varied from 131 to 138 pounds for each 4 d box nail up to 275 pounds with 8 d box nails; for the other materials (excepting material B) loads averaged only from 45 to 59 pounds per nail for 1½ galvanized roofing nails and 4 d box nails. Material B with 4 d box nails, required from 92 to 101 pounds per nail.

The superior hardness and splitting-resistance of Douglas fir plywood were evident.

Flexural Tests—Deflection curves, based on a comprehensive series of tests conducted at the Forest Products Laboratory of the University of Washington, are shown on Page 11, under concrete form panels.

These tests show that 5/8-in. plywood sheathing is equal to diagonal flooring as to strength and deflection and furnish the engineer and architect with data to permit use of plywood in a multitude of structural designs.

Representative Plies and Thicknesses of DOUGLAS FIR PLYWOOD



¼ in.—3 ply
Used largely for drawer bottoms, case and picture backs, and toys. Most Douglas Fir Plywood wallboard is made in this thickness.

⅜ in.—3 ply
Manufacturers of refrigerators, trunks, kitchen cabinets, store fixtures, auto body parts, and instrument cases use this construction.

½ in.—3 ply
This is an economical shelf material for cabinets of all kinds. Also used in auto body parts, incubators, etc.

½ in.—5 ply
This construction is superior to that just above, both in tensile and in transverse strength. When ½ in. is required in large sheets this construction is recommended.

⅝ in.—5 ply
In floor boards, lock boards, seat frames and other automobile body parts and for concrete forms, etc., this thickness finds especial favor.

¾ in.—5 ply
Used by auto body manufacturers preferring a heavier floor board. Also recommended for heavy shelf construction, store fixtures, concrete form lumber.

⅞ in.—7 ply
Furnishes extraordinary, well-balanced strength. Much used in ship building for bulkhead panels, stateroom partitions, etc.

1 3/16 in.—7 ply
Widely used for instrument boards, ice machine bases, desk tops, bus seats and a variety of other purposes requiring an exceptionally strong and rigid board.

TABLE OF DOUGLAS FIR PLYWOOD STANDARD SIZES

Item	Widths	Lengths	Thicknesses
Standard Panels	From 12″, increasing by 2-in. units to 30″; also 36″, 42″, and 48″	48″, 60″, 72″, 84″, and 96″	3/16″ (3-ply sanded 2 sides) increasing by 1/16″ thicknesses to 1 3/16″ (7-ply)
Wallboard	30″, 32″, 36″, and 48″	60″, 72″, 84″, and 96″	3/16″ unsanded; ¼″, ⅜″ 3-ply sanded 2 sides; and ½″ 5-ply sanded 2 sides
Sheathing	48″	60″, 72″, 84″, and 96″	5/16″ and ⅜″ 3-ply unsanded, and ⅝″ 5-ply unsanded

Douglas Fir Plywood Grades

(See U. S. Commercial Standards, CS45-36)

Good Two Sides (G-2-S)—This grade is intended for natural or light stain finishes. Both faces are clear and 100% heartwood of a yellow or pinkish color.

Good One Side (G-1-S)—One face is the same as that described under Good Two Sides grade, while the opposite face is the same as the Sound Two Sides grade described below.

Sound Two Sides (SO-2-S)—This grade presents a smooth, sound surface on both sides suitable for painting. The faces may be of one or more pieces of firm, smoothly cut veneer. If of more than one piece, they will be well-joined and reasonably matched for grain and color at the joints. Sap and natural discoloration are considered no defect.

Wallboard (W-B)—The face side is the same as described under Sound Two Sides. The opposite side contains defects in number and size that will not affect the strength or serviceability of the panel.

Sheathing—Both faces of this 3-ply 5/16-in., ⅜-in. and ⅝-in. unsanded plywood contain defects which will not seriously affect strength or serviceability.

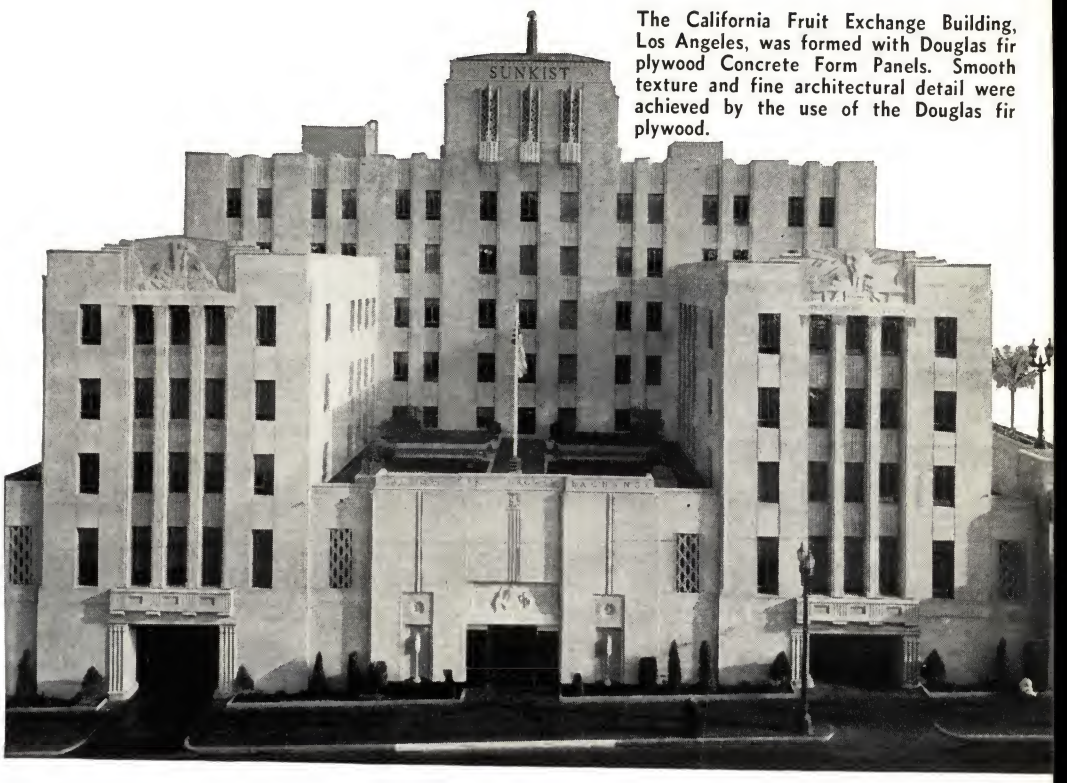
Concrete Form Material—(Made in standard panel dimensions with special highly water-resistant glue). ⅝-in. thickness is recommended for most form jobs, but ½-in., 9/16-in., 11/16-in. and ¾-in. panels are stocked in standard panel widths and lengths. Both faces are carefully selected and sanded so that concrete surfaces will be smooth and true, thus eliminating costly rubbing labor. When specified, panels will be mill-treated with special water-repellant oil at nominal cost. Panels ¼-in. thick are available as form liners and for curved surfaces.

Automobile and Industrial Stock—(Rough). In ½-in. to ⅞-in. thicknesses. Faces are free from knot-holes, but tight knots are admitted.

For SMOOTH, FINLESS CONCRETE . . .

Specify DOUGLAS FIR PLYWOOD

Concrete Form Panels



The California Fruit Exchange Building, Los Angeles, was formed with Douglas fir plywood Concrete Form Panels. Smooth texture and fine architectural detail were achieved by the use of the Douglas fir plywood.

★ *UNIQUE NEW FORM MATERIAL*

Few developments in building construction have so quickly commanded acceptance in every section of the country as the new specially-fabricated-and-treated Concrete Form Panels of Douglas fir plywood. Already, therefore, the following special advantages of this unique new material—which serves as sheathing-and-lining combined—have been demonstrated on thousands of buildings, bridges, viaducts, residence foundations and cellars, and other structures requiring flawless surfaces.

1. Highly water-resistant—may be used 7 to 15 times and more.
2. Saves 40% to 75% carpentry labor.
3. Speeds up stripping.
4. Gives smooth, finless surfaces immediately.
5. No costly rubbing or plastering necessary.
6. Split-proof, non-bulging, ideal for reverse molds.
7. Giant sizes reduce lineal footage of joints. (Stock sizes up to 4 x 8 ft., larger sizes on special order.)

Although the ⅝-in. thickness is preferred where a number of reuses are desired, ¼-in. stock plywood is popular for lining forms, particularly for arches and other curved surfaces, where only one or two uses are needed.

Because of economies of labor and salvage the *⅝-in. panels cost less than ordinary form materials.*

This new form material is made of thin sheets of selected old-growth Douglas fir, laminated with alternating grain direction for split-proof, warp-resistant strength. These sheets are bonded with a special glue that is highly water-resistant and far stronger than the wood fibers themselves. Finally each panel is sanded and thoroughly treated with a water-repelling agent developed especially for fir plywood.

This double waterproofing protection gives these special panels stamina for 7 to 15 reuses, after which they are still suitable for sheathing, subflooring, and other utility uses.

★ *SAVES 40% TO 75% CARPENTRY LABOR*

With these giant panels—4 x 8 ft., or even larger on special order—carpenters can erect forms with only a fraction of the handling, sawing and nailing required by ordinary lumber, and the use of the ⅝-in. panels saves all the extra labor of lining forms.

Concrete Form Panels of Douglas fir plywood also reduce the labor cost of fastening reverse molds. These can be nailed or screwed close to the edges of the plywood without fear of splitting. Even the smallest brad may be easily driven without previous drilling.

For curved forms, the ¼-in. panels can be bent without steaming to a radius as small as 15 inches.

Douglas fir plywood can be cut easily with either power or hand saws. Also it is remarkably lightweight in proportion to its extraordinary strength. A 4 x 8 ft.

Lower left: Schmitz Park Bridge, Seattle, a long rigid span of cellular concrete formed with Douglas fir plywood Concrete Form Panels.

Lower right: Triborough Bridge, New York, winner of the 1937 award for architectural excellence, owes part of its magnificence to the unblemished concrete surfaces formed with Douglas fir plywood Concrete Form Panels.

panel of 5/8-in., for example, weighs only about 55 lbs., and a 1/4-in. panel of the same size weighs only about 24 lbs. Whole sections of forms can be hoisted easily into place.

Specially shaped or shiplapped edges may be obtained on special order at little extra cost. In some types of forms, such edges eliminate fillets and quarter rounds, and simplify dismantling.

★ NO COSTLY RUBBING OR PLASTERING

So smooth are the sanded surfaces of this material, and so greatly do the large, tight-fitting panels reduce the footage of joints, that practically no rubbing is necessary. The joints stay tight because of Douglas fir plywood's stubborn resistance to shrinking and swelling. Thus all the moisture is retained in the concrete preventing honeycombed surfaces, as well as "fins."

Douglas fir plywood's virtual elimination of rubbing means a saving in this one respect alone of 5¢ to 15¢ a square foot. And if stucco or paint is desired, the smooth surface requires much less of either, and of course much less labor. The fact that Douglas fir plywood requires no overlapping edges means that 1000 sq. ft. of it cover 1000 sq. ft. of surface, thus saving the cost of the extra 20 to 30 per cent of material ordinarily allowed for matching and cutting.

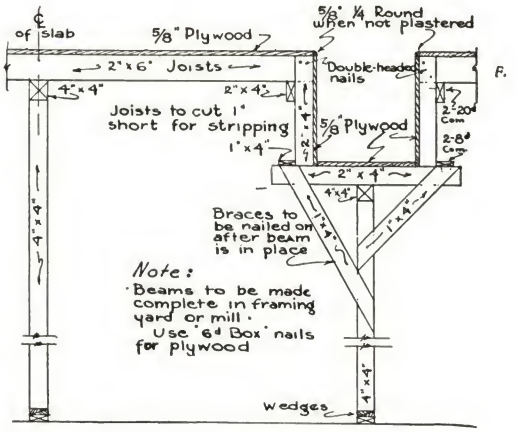


Figure 1

Figure 1—The beam and slab form in figure 1 indicates the simplicity of plywood for formwork.

Beam sides and bottoms, like column panels, can be fabricated in the shop with a simple jig for spacing the 2x4-in. supports to which 8-ft. plywood panels are nailed. The light weight of plywood and absence of cleats make easy the handling of such built-up forms.

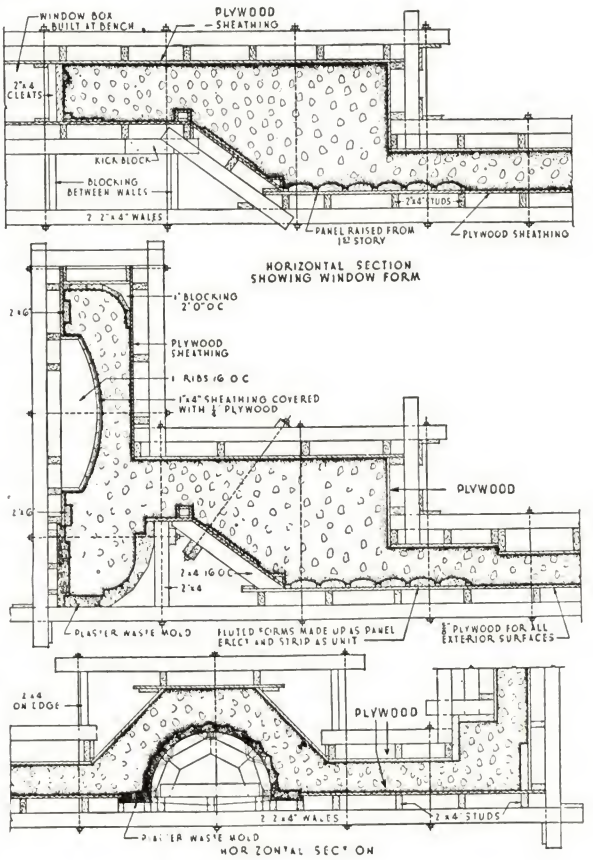
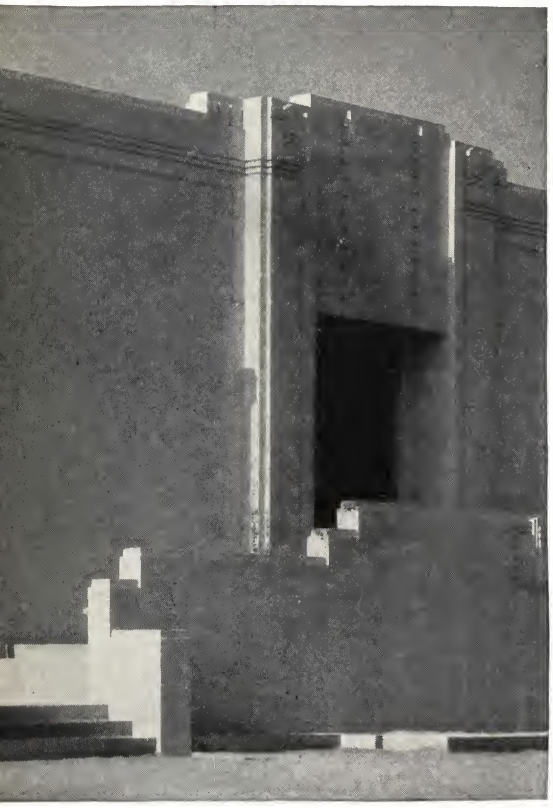


Figure 2

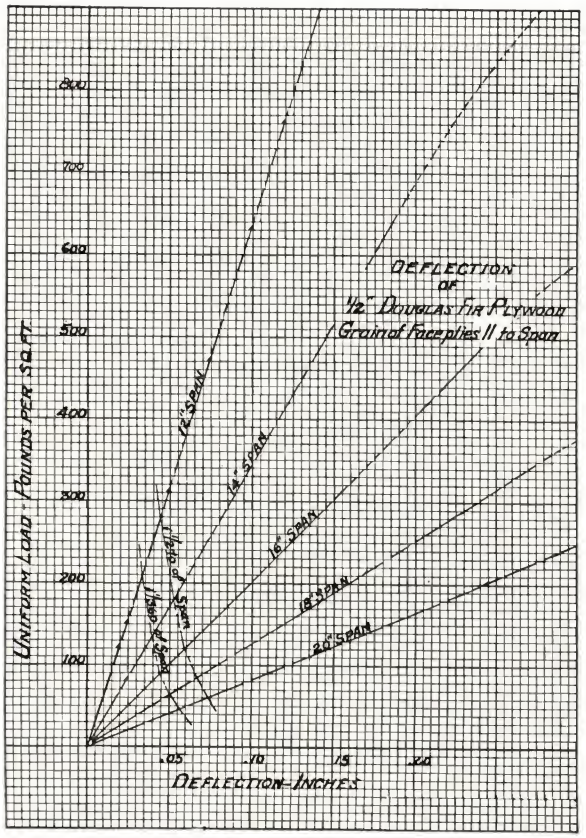
Figure 2—Figure 2 is taken from a typical job. The architect's design called for a relatively smooth finish to which plywood form sheathing was well adapted.

The versatility of Douglas fir plywood is evidenced by its use as sheathing for exterior walls, both flat and curved, and as a base to which are attached various moldings, boxes, and other items that will produce desired architectural features.



Above: **The fine architectural detail of the Grover Cleveland Elementary School, Pasadena, was obtained with Douglas fir plywood Concrete Form Panels.**

Right: **Smooth monolithic residence foundations are formed with Douglas fir plywood Concrete Form Panels. Reuse of these standardized form units on similar foundations introduces new economies.**



★ QUICK STRIPPING

The giant Douglas fir plywood panels make it possible to strip forms in a fraction of the usual time, and the rugged, laminated construction of this material minimizes dismantling damage.

★ EXTRAORDINARY STRENGTH

The remarkable strength of Douglas fir plywood—demonstrated by laboratory tests and actual experience—means that the panels will never crack or bulge, when properly supported.

However, studs should not be spaced farther apart than on ordinary lumber forms. As in all concrete work, if pouring is faster than 3 ft. an hour, special care with bracing, waling strips and ties is necessary. When the ¼-in. lining is used, the forms need not be built up solidly with lumber. Spacing between the boards can be from 2 to 4 inches.

Deflection Charts

These charts show deflection of Douglas fir plywood when acting as a simple beam, i.e., resting on only two supports, *without any nailing.*

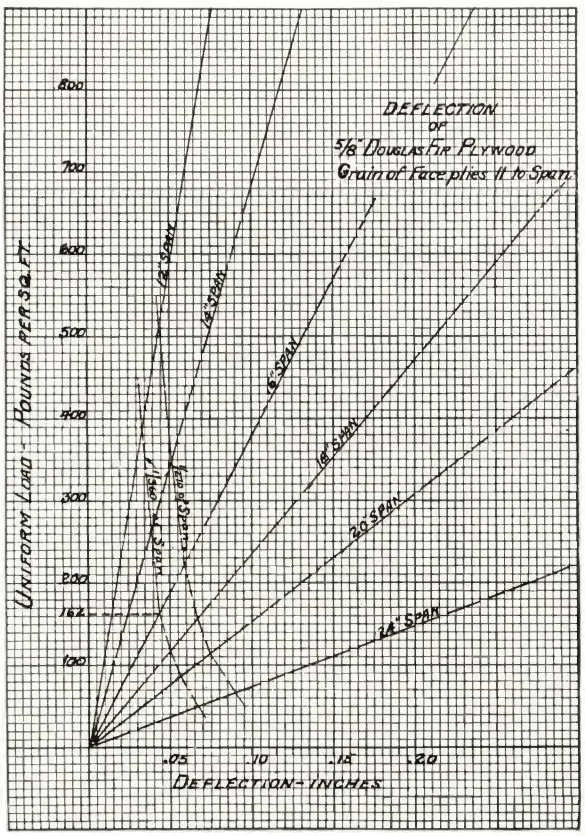
The charts are based on a comprehensive series of tests conducted recently at the Forest Products Laboratory of the University of Washington. The results are in accord with the theoretical deflections computed as tentatively recommended by the United States Forest Products Laboratory at Madison, Wisconsin.

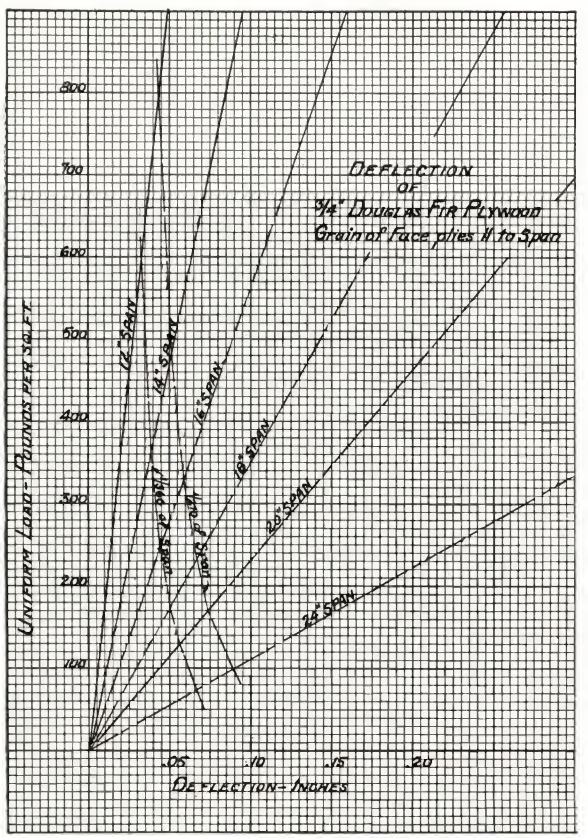
For convenience, lines have been added to show deflection of 1/360th and 1/270th of the various spans. For example, using ⅝-in. plywood over a 16-in. span, with deflection limited to 1/270th of span, as in most concrete work, a loading up to 221 lbs. per square foot may be used. If the supports are placed only 12 in. apart, the loading may be increased to 510 lbs. per square foot.

If load is continuous over two or more spans, the deflection will be approximately ½ that shown, and therefore, twice the load shown may be used.

The charts show the deflections of Douglas fir plywood when the grain of the face plies is parallel to the span, i.e., when panels are placed lengthwise across the supports. When panels are placed parallel to the supports, the loads causing any given deflection will be smaller than shown on the charts, as follows:

For ½-in. thickness, use 40% of load on chart;
For ⅝-in. thickness, use 50% of load on chart;
For ¾-in. thickness, use 75% of load on chart;
for any given span and allowable deflection.





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